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STRATA CONTROL INVESTIGATIONS IN THE SYDNEY COALFIELD

Biannual Report July 1 to December 31, 1983.

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Cape Breton Coal Research Laboratory

January 1984

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JUL 2 0 1984

20 pp

ENERGY RESEARCH PROGRAM
COAL RESEARCH LABORATORIES
DIVISION REPORT ERP/CRL 84-8(IR)

84- 3624 /

STRATA CONTROL INVESTIGATIONS IN THE SYDNEY COALFIELD

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by

W. D. Gallant*, S. O'Leary*, T. R. C. Aston** and P. Cain**

SUMMARY

This report reviews the work undertaken by the Strata Mechanics Section of the Cape Breton Coal Research Laboratory (CBCRL) for the period 1st July to 31st December, 1983. It provides a brief description of the activities undertaken in the Lingan, Number 26 and Donkin Morien mines as well as the results obtained and the current status of other ongoing research programmes being undertaken in the Sydney Coalfield.

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ÉTUDE DES PRESSIONS DE TERRAIN DANS LE GÎTE DE CHARBON DE SYDNEY

Rapport semestriel du 1er juillet au 31 décembre 1983

par

W. D. Gallant*, S. O'Leary*, T. R. C. Aston** et P. Cain**

SOMMAIRE

Le présent rapport est une revue des travaux entrepris par la Section de la mécanique des pressions de terrain du Laboratoire de recherche sur le charbon du Cap Breton (LRCCB) au cours de la période s'échelonnant du 1er juillet au 31 décembre 1983. Il établit une brève description des activités entreprises dans les mines Lingan, Numéro 26 et Donkin Morien, des résultats obtenus et de l'état actuel des autres programmes de recherche exécutés dans le gîte de charbon de Sydney.

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INTRODUCTION

During the period 1st July to 31st December, 1983, the Strata Mechanics Section of CBCRL has undertaken a variety of work at the CBDC Lingan, Number 26 and Donkin Morien mines. No work was undertaken at Prince Mine during this period. New research activities have been initiated and ongoing programmes continued. This report is intended to provide a brief description of the activities undertaken, the results obtained and the current status of ongoing work.

GATEROAD DEFORMATION STUDY

Between June and December, 1983, field surveys at the Lingan and Number 26 mines have resulted in over 4000 measurements and 400 photographs being collected from 35 km of accessible gateroad. Additional information was tabulated from mine plans and records and the whole data package stored on computer. Analysis of the Lingan data has been started and it is expected that a preliminary report will be available during early February, 1984.

A report outlining the field data collection methodology is currently in preparation (1).

GOB/AIR LEAKAGE STUDIES

Air leakage from the maingate, across the gob and into the return gate can be a serious problem on advancing longwall coalfaces at Lingan and Number 26 collieries. To assist CBDC with the problem, CBCRL were asked to produce a research programme to fully investigate the phenomena. A duel approach was therefore formulated, which comprised both geotechnical and ventilation components. Essentially, the effects of pack behaviour on the formation of leakage pathways would be evaluated by the geotechnical programme, while tracer gas studies (ventilation programme) would be used to identify the leakage pathways. A report outlining the proposed research programme is given elsewhere (2).

NUMBER 26 COLLIERY

ROCK BURST INVESTIGATION

On 24th November, 1983, a rock burst occurred at the bottom of the main deep immediately after the face had been shot. The following day CBCRL staff visited the site and observed that 17 arches had been destroyed and the roadway filled with broken rock and support debris.

A history of 'bursts' exists around the 14 North and base of the 'deeps' area. Geologically, the coal is overlain by less than 3 m of mixed sediments (mainly siltstones and mudstones) on top of which lies a well developed sandstone. A report describing the nature of the Number 26 bursts, their similarity to occurrences in other mining areas and methods for their prevention is currently in preparation (3).

Preliminary discussions have occurred between CBDC and CBCRL staff regarding the nature and prevention of rock bursts. Microseismic monitoring techniques have been suggested for their prediction. However, to date no conclusions have been reached, although further discussions and field activities are expected once the results from the in situ stress determination study become available.

IN SITU STRESS DETERMINATION

In November, 1983, Golder Associates were awarded a contract to carry out a series of in situ stress determinations at Number 26 Colliery. After a series of preliminary meetings and field visits, a site was chosen on the 14 South Coalroad. Drilling commenced on December 5, 1983, with tests being undertaken using both USBM and CSIR techniques in orthogonal boreholes.

A final report containing the site description, instrumentation, methodology and results is expected by February/March, 1984.

COMPARISON OF SWELLEX BOLTS AND REBAR DOWELS

On September 7, 1983, rock bolt pull tests were conducted on the faceline of the 13 North Panel adjacent the Material Road gate end (4).

Originally, 20 bolts were to be tested, 10 'Swellex' and 10 rebar dowels. Unfortunately, due to logistics problems and bad roof conditions,

'Swellex' Bolt No	Failure Load (Tonnes)	Comments
1	10.5	Pulled flange from end of bolt, even though bolt stem still firm.
2	11.0	Same as (1)
3	*12.0	Insufficient ram left to continue testing to failure.
4	*11.0	Insufficient ram left to continue testing to failure caused by excessive breakage of rock around collar bolt.
5	*10.0	Loaded to 10 tons before insufficient ram left to continue testing. A second test after repositioning loading ring resulted in excessive bending of the bolt collar which subsequently failed at 9.0 tons.

* Greatest pre-failure load attained

Table 1 'Swellex' Bolt Testing, 13 North Faceline, No. 26 Colliery, September 7, 1983

X - BOLT NUMBER

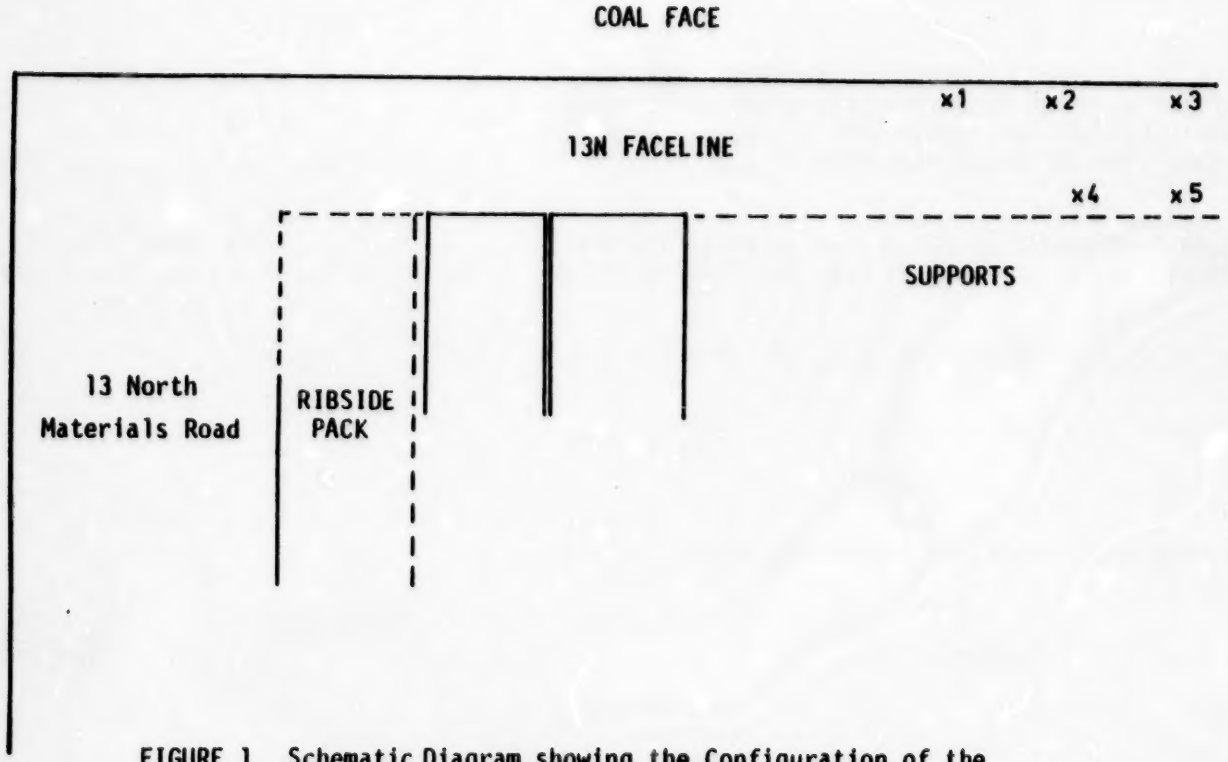

FIGURE 1 Schematic Diagram showing the Configuration of the Installed 'Swellex' Bolts on 13 North Faceline, No. 26 Colliery, September 7, 1983

only 5 'Swellex' bolts were tested, Table 1, and no rebar dowels. Figure 1 shows the site and test array.

Results from the tests can be summarized as follows:

1. Installation of the 'Swellex' bolts was simple.
2. In each case, failure of the 'Swellex' occurred between 10 and 12 tons at the bolt collar, even though the main stem of the bolt remained secure.

Finally, from this and previous testing (5), the 'Swellex' bolt appears both simpler to install and more consistent with regard to failure load than the rebar dowel. The rebar dowel does however give greater failure loads when properly installed.

LINGAN MINE

FACE END BRUSHING

Discussions concerning brushing practices at Lingan have occurred between CBDC, CIL, Labour Canada and CBCRL personnel and the following problems identified:

1. Poor profiling results in poor strata control.
2. Poor breakage increases the bulk volume, which results in material being left in the gate.
3. Material left in the gate decreases the cross-sectional area, reduces ventilation and promotes haulage rope damage.
4. Large stones are difficult to remove and increase the incidence of injury.

As a course of action, a joint monitoring programme was established between CBDC and CBCRL. Existing practice was monitored with respect to the following criteria:

1. Drill pattern, hole orientation, delay pattern and explosive weight distribution.
2. Geological description of brushed material.
3. Record of shot overbreak
4. Photographic record of shot.

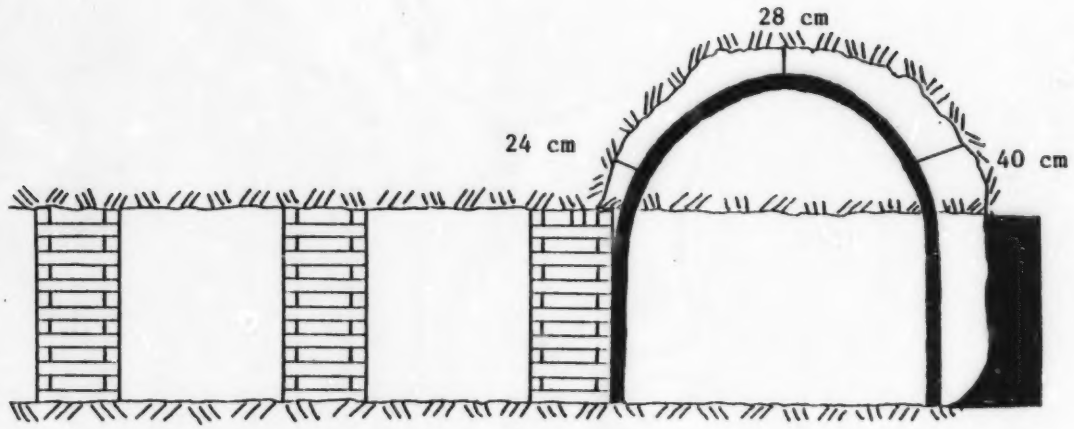

FIGURE 2 - Schematic cross section of gate end showing average overbreak.

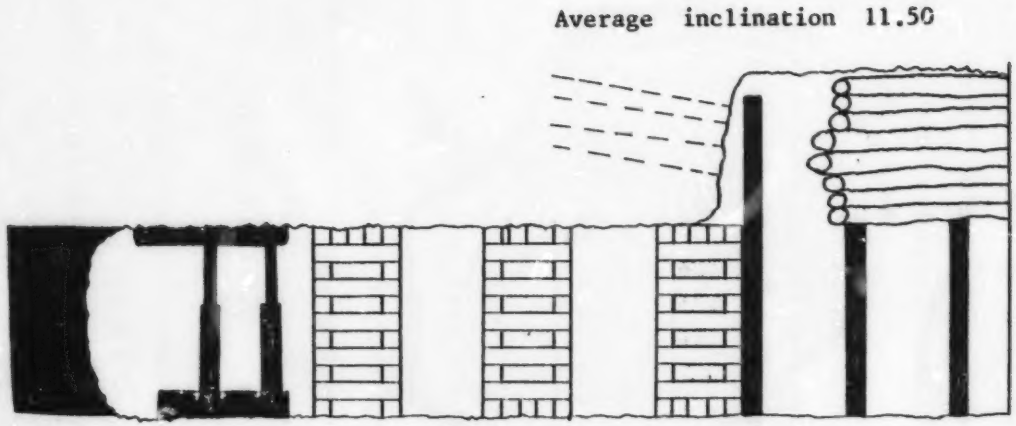

FIGURE 3 - Schematic long section of gate end.

The results of the monitoring programme with respect to current practice are as follows:

1. Average time to brush and place 2 arches - 3 hr. 40 min.
2. Average overbreak (Figure 2) 24 cm low side
   28 cm crown
   40 cm high side
3. Average inclination of shot holes (Figure 3) - 11.5°

This results in a 30 cm difference in elevation between the collar and toe.

In mid December, monitoring of the brushing ceased, but it is expected that early in the new year further discussions will take place in order to evaluate the results obtained and identify areas where changes to existing operations can be readily brought about.

DONKIN MORIEN MINE SITE

ROCK SUPPORT INTERACTION STUDY

During October/November, 1983, Golder Associates installed 5 extensometer arrays in the Donkin Number 3 tunnel as part of the ongoing Donkin Morien Rock Support Interaction Study.

At the Number 3 tunnel faceline, chainage 1000 m, 3 Irad Gage rod extensometers were installed with anchors at 3 m, 10 m and 21 m. The orientation of the holes is one vertical (crown) and two horizontal (one in each rib), Figure 4.

In addition, extensometers were also installed in two near horizontal boreholes located at chainage 800 m and 900 m on the west side of the Number 3 tunnel wall. The object of these boreholes is to intersect the projected east side wall of the Number 2 tunnel. Anchors were installed at 3 m, 7 m, 10 m and 21 m from the Number 2 tunnel east side wall, Figure 5.

Currently, all the extensometers are being periodically monitored to establish base readings and determine whether any 'drift' is occurring with the instrumentation. Increased monitoring will occur when the Number 2 tunnel starts to reach the vicinity of the extensometer sites, which is predicted for March, 1984.

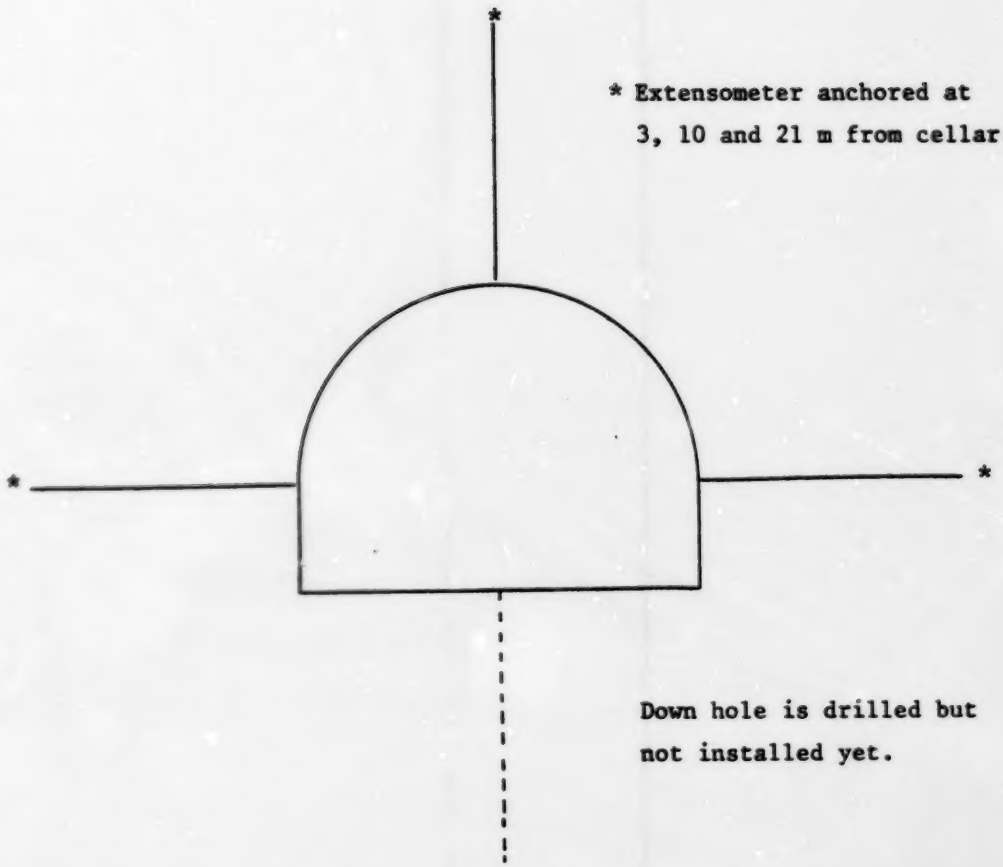

FIGURE 4 - Profile of tunnel No. 3 at 1000 m
Donkin Mine

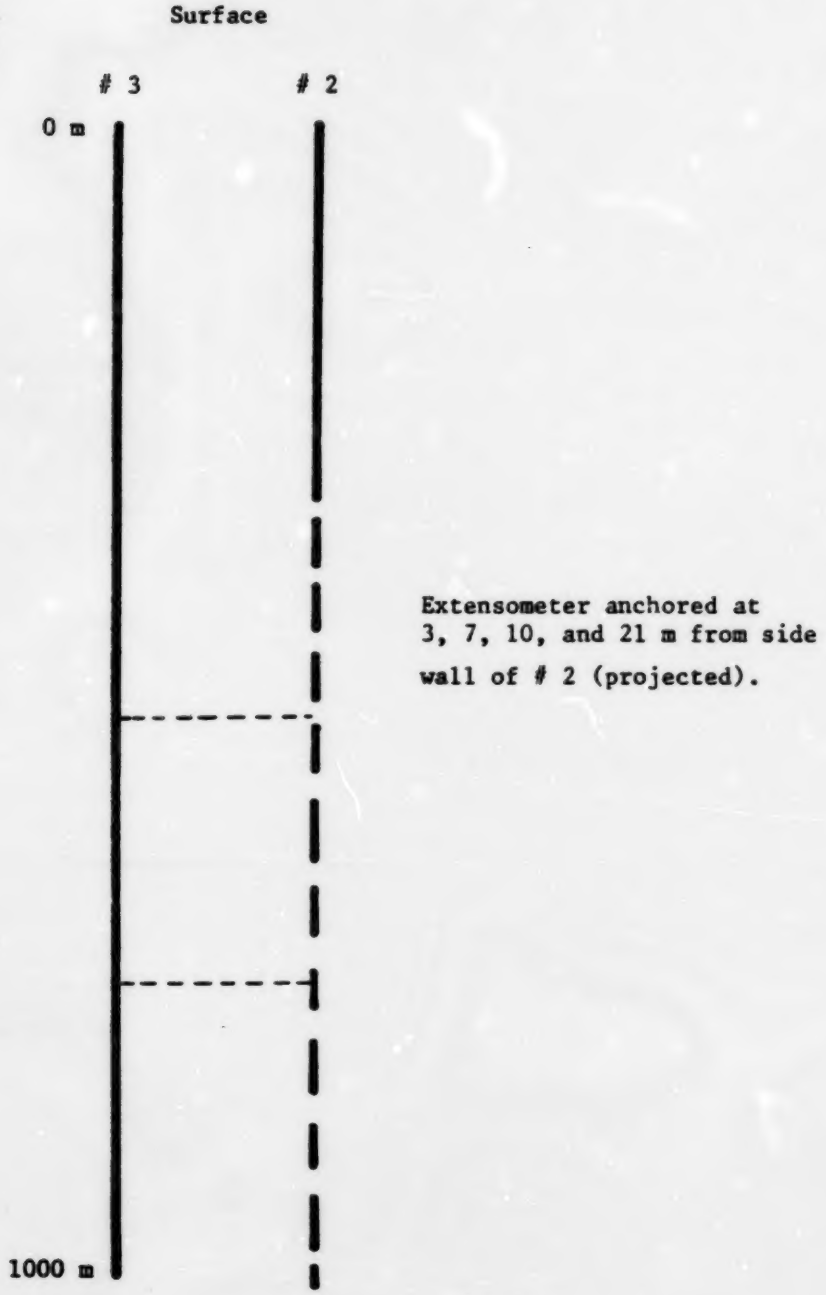

FIGURE 5 - Schematic plan view of Donkin Mine.

MINE WATER DATA BASE

In March, 1983, a hydrochemical sampling programme was initiated at the Donkin fresh water well in order to monitor the progress of a salt water intrusion. Initial results collected between March 22 and May 12 indicate that the well water quality improved slightly and then went into a period of stability.

Since May, monitoring has continued on approximately a two-week interval, although the results have not yet undergone analysis. A detailed review of the data is anticipated early in the new year.

STRATA MECHANICS FIELD AND LABORATORY EQUIPMENT STATUS

At present, the Strata Mechanics Section of CRCRL is equipping for both laboratory and field investigations. In the laboratory a fully equipped rock preparation/testing/property facility is envisaged. Similarly, a variety of versatile 'state of the art' field instrumentation is either being acquired or developed. Unfortunately, most of the laboratory equipment cannot be utilized until renovations to the building are completed, which is not expected until the last quarter of 1984. A detailed list of the laboratory and field equipment acquired to date will therefore be presented.

LABORATORY EQUIPMENT

1. Rock Coring Drill
   Structural Behavior Engineering Lab, Inc.
   Model 3700
   Infinitely Variable Spindle Speed
   Constant Load Device
   14" BW Double Core Barrel
   14" NW Double Core Barrel
   14" HW Double Core Barrel
   14" PW Double Core Barrel

2. Circular Rock Saw (Slabbing Saw)
   Highland Park Manufacturers
   Model 2455
   24" Blade
3. Cut Off Saw
   E. L. E.
   Model GSP - 210/250
4. Lathe
   Colchester "Triumph 200"
   50" Gap Bed
5. Surface Grinder
   Hartig 618 Auto-step
6. E. L. E. Point Load Tester
   Accessories, Spares Kit
   EL77 - 011

FIELD EQUIPMENT

1. Nikon Nikonos IV-A Underwater Camera
   with 35 mm lens
2. *Flash Unit
   General Energy GBS 5600 Photoflash
   Explosion proof
3. NCB Cone indenter
4. Rock Bolt Pull Test Kit
   30 ton capacity
5. Extensometer
   Irad Gage Inc.
   F525 Flexible Sonic Probe
   MB7 Sonic Probe Readout Box (20 points)
   Anchors
   Setting tools

6. Convergence Meter
   Rock Test Corp.
   7' Convergence Meter
   Digital Readout
7. Pressure Cells
   Solinst
   Flat Jacks
   Portable Readouts
   Fittings, accessories

*Waiting approval for underground use.

SUBSIDENCE PROGRAMME - SYDNEY COALFIELD

The applicability of existing subsidence guidelines (6), (7) to the Sydney Coalfield is uncertain, since they were derived from land truthed data which has subsequently been extrapolated to undersea conditions, rather than derived empirically from seabed truthed data.

In April, 1983, a document entitled "Discussion Paper: Subsidence Research in the Sydney Coalfield"(8) was circulated within CBDC and CANMET. In November, 1983, a visit was made to West Germany and Great Britain to determine at first hand the current status of subsidence research in both countries and assess its application to the Sydney Coalfield. On the basis of this visit and previous preparatory work, the subsidence research planned for the Sydney Coalfield can be separated into three interrelated components:

1. Evaluation of existing subsidence criteria to the Sydney Coalfield.
2. Effective sealing of offshore exploration boreholes.
3. Determination of in situ permeability changes between the mining horizon and seabed.

A document outlining the present status of subsidence research in both West Germany and Great Britain and its application to the proposed programmes for the Sydney Coalfield is currently in preparation.

Finally, early in 1984 a research contract will be let to conduct "A review and evaluation of potential data collection methods for monitoring subsidence over longwall workings in submarine coalfields".

GEOTECHNICAL DATA BASE

In early September, 1983, core samples were obtained from a Nova Scotia Department of Mines and Energy (NSDME) exploration borehole in the Springhill area. After logging by NSDME geologists, the core was sent to CBCRL, Sydney. Subsequently, sections of the core were sent to Jacques Whitford, Halifax, and the MRL Laboratories in Ottawa for testing. As yet no results from this testing programme have been received.

In addition, core samples from the extensometer boreholes in the Donkin Morien Number 3 tunnel have been sent to the MRL Laboratories in Ottawa for testing.

ACKNOWLEDGEMENTS

The Cape Breton Coal Research Laboratory gratefully acknowledges the support and assistance of Cape Breton Development Corporation personnel who assisted in all aspects of this work. In addition, thanks are also due to the Nova Scotia Department of Mines and Energy and Golder Associates personnel who were also involved in aspects of the work.

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